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ABSTRACT

A study was conducted to examine cognitive levels in adults (using Peel's tasks of logical judgment) and to assess their relationship to reading comprehension and various demographic variables. Subsequent to testing their reading comprehension with the California Achievement Test (CAT), forty-one adult education students ranging in age from sixteen to sixty-two were asked to read seven passages adapted from Peel's logical judgment tests and, after each reading, to make a judgment and explain the reasoning. The subjects' responses were rated on each of two dimensions: coordination of information and the data source used. The major findings were (1) concepts of language structure vary in adults, (2) the degree of success on the language concepts measure covaries with reading level for adults in a reading skill development program, (3) good interrater reliability was attained, (4) logical judgment was not related to achievement, (5) results were similar across sex and ethnic groups, (6) differences by age were a peculiarity of the sample, and (7) the factors observed included one which described interrelationships of sex, age, and ethnic status and one each for achievement, language concepts, and local judgments. Given the limitations of the study, adults' performance on the Peel tasks was unrelated to performance on the CAT. (The logical judgment tasks and scoring guidelines are appended.) (EM)

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Cognitive Levels in Adult Basic Education Students

Final Evaluation Report

for the

Bureau of Special Continuing Education

New York State Education Department

Project Title:

A Research Study Aimed at

the Adaptation of Tasks

for the Measurement of

Logical Judgments in Adults

Project Number: C106136

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Prepared by:

The State University of New York at Albany

Dr. Joseph A. Bosco and Staff

July, 1976

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TABLE OF CONTENTS

		Page
I.	Background	1
II.	Logical Judgment, Language Concepts, and Reading Comprehension in Adult Basic Education Students	6
	Methods	10
	Scoring	11
	Results	12
	Logical Judgments	12
	Factor Structure for Peel Logical Judgment Rating	19
	Achievement	21
	Linguistic Conservation	21
	Factor Analysis of the Major Variables	23
	Factor Analysis of the Major Variables and the Demographic Variables	27
	Multiple Regression	33
	Summary	38
	Implications	38
	Tasks and Scoring for Measure of Logical Judgments in Adults	42

FINAL REPORT
COGNITIVE LEVELS
IN ADULT BASIC EDUCATION STUDENTS

Barbara A. Hutson

I. Background

The first part of this report describes the process undertaken in examining cognitive levels in adults and assessing their relationship to reading comprehension and other variables of interest. The second part describes the product, the study executed and analyzed as a result of this process.

Activities undertaken in behalf of this project fell into these groups: a) literature search; b) gathering especially pertinent literature; c) consultation with personnel involved in various capacities in adult education (New York State Education officials, teachers or directors of ABE programs or ABE teacher preparation in upstate New York, New York City, Texas, Missouri, and phone contact with federal office for ABE), and preparation and tryout of testing materials; d) development of a tentative plan for evaluation of cognitive processes in adult basic education students; e) execution of the study; and f) analysis and interpretation of the results.

The literature searched included theoretical and empirical studies on cognitive style, cognitive complexity, and cognitive development in adolescents and adults. While cognitive style has great appeal and committed adherents, the time-consuming data-gathering process and the problems in analyzing the mountainous

data-set have perhaps made it difficult for most projects to demonstrate a favorable cost/benefit ratio for this approach. Sophisticated analysis may overcome this problem, but it was considered useful to explore other approaches for use at this time.

Cognitive complexity, as developed by Kelley and modified by Bieri, appeared to have some potential for discriminating among learners who are more or less complex in structuring perceptions of their world. This characteristic may be related to individual differences underlying ability of ABE students in dealing with comprehension at literal, inferential, and creative levels. Bieri's modification of the format was relatively easy to administer and with the talented data analyst available on this project, both scoring and analysis could easily be automated. Correlations of this measure with achievement, however, have been noticeably low. The content (social relationships) was somewhat different from the content of most reading achievement measures. The relationship of cognitive complexity and reading comprehension, though of interest, may be somewhat indirect.

Recent studies from the Piagetian viewpoint have given greater consideration to individual and group differences among adults in logical development. Differential difficulty in reading material and types of comprehension questions appears to be a function not only of word-level units but of structural relationships among the facts in a passage. Reading material differs in the degree to which it specifies or implies relationship among facts; adult learners differ in the degree to which they can comprehend, infer

or supply these relationships and the relationship with other knowledge they possess. For these reasons, a Piagetian approach to cognitive levels in adult basic education students had potential.

Most of the Piagetian tasks, however, involved materials far removed from reading comprehension tasks. A man may perform relatively well on a pendulum task or a bendable pipes task of formal operations and yet have considerable difficulty in applying similar operations to verbal propositions. On the other hand, the second major group of Piagetian tasks, which employ verbal-symbolic material such as $A \cap B$, may lack face validity in the target population and be viewed as artificial and irrelevant. Inclusion of some late concrete operational (especially matrices and class inclusion) and formal operational tasks in the evaluation would be of interest but perhaps not as the central instrument.

Related to Piaget's work but emphasizing the application of concepts of cognitive development in subject matter areas is the work of Peel in Britain. By analyzing the responses of adolescents and adults to simple questions following a paragraph of written material, it is possible to categorize several levels of judgment.

Although the skill involved was surely related to comprehension, the task does not assess comprehension per se. A fully adequate answer is not to be found in the paragraph, but in the manner in which a person relates facts given in the story to one another and to his previous knowledge, and evaluates the feasibility of making such judgments based upon the information supplied.

The levels of judgment found by Peel and his many associates seemed, at least analytically, to have potential for relatively direct relations with levels of comprehension:

Logical Judgment	Comprehension
Irrelevant or distorted	(Word-calling only)
Bases judgment on 1 fact, ignores conflicting information	Literal
Bases judgment on 2 or more facts	Inferential
Goes beyond the facts to relate them to his other knowledge	Creative

A number of passages and questions used by Peel and his associates were gathered together into an evaluation instrument, with appropriate modification of vocabulary and unfamiliar British references and spellings. This instrument was field tested January 29 with ABE workshop participants, including teachers, supervisors, and students from New York State correctional facilities. Responses yielded useful insight into response tendencies, scoring issues, comments on suitability of reading level and content for ABE and GED students.

When this feedback was analyzed and weighed, appropriate modifications in procedures and materials were performed and used for the next stage. An interview was conducted on February 4 to discuss with the director and staff of the Schenectady Adult Learning Center proposed strategies for evaluation and related issues. Their suggestions were considered and concrete plans

were made for a formal tryout, consisting of: 1) Peel's logical judgments; 2) concepts of language structure; and 3) California Achievement test scores. This plan was of course subject to modification depending upon release of students for testing and scheduling of testers and other constraints.

At each step, formal or informal formative evaluation guided choices at decision points. The first phase involved a broad exploration of theoretical bases and operational procedures for analysis of cognitive levels in adults. The second phase consisted of development and field testing of an instrument for analyzing cognitive levels. Upon completion of this phase, formal tryout of the revised instrument and related measures was undertaken. The remainder of this report will describe the study mounted.

II. Logical Judgments, Language Concepts, and Reading Comprehension in Adult Basic Education Students

In teaching children, our lack of understanding of the development of comprehension is fortunately camouflaged by time. With the help of time and general cognitive development, most of the children we teach eventually achieve at least literal and inferential comprehension skills. In teaching adults who have not attained basic academic skills, time is less helpful.

Some adults who have had little opportunity for schooling show steady progress once they enter an appropriate educational program. Others may show rapid initial progress and then begin to founder and to plateau. Teachers of adult basic education students often find a few students who do well in decoding and literal comprehension but have trouble getting past fourth or fifth grade reading levels, where there is increasing demand for inferential and interpretive comprehension skills.

It is likely that the difficulty of the task, both in terms of the readability of the material (Klahr, 1975) and of the type of questions asked (Bormuth, 1970), affects comprehension. It is also likely that the reader's characteristics, such as familiarity with a specific topic (Ausubel, 1962) and general cognitive level (Piaget, 1963), affect comprehension. The impact of a student's cognitive level on general comprehension is the focus of this paper.

Levin (1973, p. 19) operates from the premise that "reading comprehension involves complex organizational strategies on the part of the reader, through which he detects meanings and interrelationships of the substantive material within the passage."

Not all adults achieve the highest cognitive levels (Piaget, 1972, Elkind, 1962), and several characteristics seem related. Goodnow (1962), Peluffo (1967), and Papalia (1972) find that large differences in education are reflected in cognitive levels.

Neimark (1975), citing studies by Inhelder (1966), Jackson (1965), and Stephens et al. (1971) with subjects in the dull normal range (IQ 60-80), comments (p. 580): "In no instance is there any evidence that these subjects attain formal operational thought." And yet both Piaget (1972) and Ausubel (1962) point out the cautions needed in interpreting such findings. Not only does the age of transition vary across cultures and across individuals, but an individual may show in certain highly familiar areas a level of development he does not display in formalized tasks with unfamiliar content.

Adult Basic Education students, even when tested with material in which concepts are not entirely foreign, are likely to vary in cognitive levels; and cognitive level may be related to a student's ability to deal with questions beyond the literal level. There is evidence that, at least for children, success in conservation and other concrete operational tasks is related to reading (Brekke & Williams, 1975; Brauchler, 1974; Backus, 1974; Colter, 1965), lending support to the attempt to identify cognitive processes relevant to comprehension.

Stauffer has explicitly described reading as a cognitive activity, and has described at length teaching procedures designed to provoke the student to apply cognitive strategies to the act

of reading, but has been less involved in close analysis to the strategies in a manner that facilitates research. Peel's work in England, though not specific to reading, provides procedures for eliciting and analyzing adolescents' logical judgments. The research of Peel and his students is, on the one hand, conceptually akin to Piaget's formulation of cognitive development, and has, on the other hand, been linked to achievement in a number of content areas.

Bormuth, on the other hand, (1970, p. 49) finds it unfortunate "that comprehension is presently defined almost wholly in terms of mental processes," since attempts to describe these processes often "turn out to be nebulous and confusing." Although he prefers to focus on specifiable features of language upon which comprehension operates, one might argue that the more complex question types Bormuth describes (e.g., anaphora and intersentential relationships) might well be defined in terms of their cognitive demands rather than specifically linguistic features. Bormuth himself states (p. 54) that "structural linguistics, alone, does not provide enough descriptive power to define all the classes of tasks which must be dealt with in comprehension... [it is] also necessary to use descriptive devices taken from rhetoric, semantics, and logic."

While Bormuth's own procedures, intended to define levels of difficulty in terms of the types of questions asked, are not directly adaptable to measuring individual differences in conceptual development related to reading comprehension, his more general point of the importance of linguistic features in reading is a strong one. Hutson (1976) has designed procedures to assess the

development of simple logical concepts about language structure, and this task (conservation of linguistic structure) was considered to be an appropriate means of assessing sophistication of language concepts in adult basic education.

The objectives of the present study were to examine:

a) the utility of Peel's tests of logical judgment with adult basic education students--not only inter-rater reliability, but the ease of training raters, the degree to which specific characteristics of the various passages appear to affect responses;

b) the relationship of the measure of logical judgment to the measure of reading comprehension. Although logical judgment was hypothesized to relate most sharply to long-range ability to succeed on higher levels of comprehension (data unavailable), it would be expected to show a moderate positive correlation with current status on reading comprehension;

c) the relationship of the measure of concepts of language structure to reading comprehension; and

d) the relationship of logical judgments to various demographic variables--age, sex, ethnic group, and number of years of schooling prior to entering the program.

Methods

Subjects: 41 adult education students ranging in age from 16 to 62, mean age 25; predominantly lower SES; 10 Black males, 6 Black females, 20 Caucasion males, and 5 Caucasion females, ranging in reading level from nonreader to 13-0, mean reading level 7-1; Schenectady Adult Basic Education Center.

Materials: Reading comprehension was tested using the California Achievement Test. Materials for testing logical judgment consisted of seven paragraphs adapted from Peel's tests of logical judgment. After reading the passage to the subject, the examiner asked the subject to make a judgment and then to explain his reasoning.

It should be clear that this test is not a measure of reading comprehension. First, the passages may be read to subjects in order to remove reading ability *per se* as a factor in assessment of logical judgment. Second, the questions asked are by design open-ended, not limited to literal comprehension. Third, the text deliberately provides some information that could be used to support more than one position.

Materials for testing conservation of linguistic structure (ability to recognize the semantic equivalence or nonequivalence of pairs of sentences) consisted of eight sentence pairs, each of which contained one active and one passive voice sentence. Sentences varied in terms of probability of occurrence (The baby was washed by the mother/The mother was washed by the baby.) and in terms of similarity or dissimilarly of meaning.

Scoring: It was felt useful to derive a scoring system somewhat more specific than that which Peel has provided, and to derive scoring guides for each passage as well as general guidelines. Scoring was not based on the answer to the first question but on certain aspects of the reasoning displayed in the total response. The results examined here were rated 0-3 on each of two dimensions:

I. Coordination of Information

0 - Supports neither position with relevant evidence or arguments.

1 - Supports one position with relevant arguments.

2 - Supports both sides with some relevant evidence, but does not coordinate them, or states that the answer cannot be determined.

3 - Resolves contradiction with relevant evidence, or specifies why the answer cannot be determined.

II. Data Source Used

0 - Uses only irrelevant facts or none; or essentially restates the question.

1 - Uses facts from the story or inferences which are little more than paraphrases or simple associations or clichés.

2 - Goes beyond the facts in the story with inferences which are related to the facts but extend beyond the facts given.

3 - Analyzes the paragraph to note irrelevancies or missing data.

With seven passages rated 0 - 3, a subject's total scores on each of these two dimensions could range from 0 - 21.

Results

The results are organized in terms of:

1. means and distributions and other relevant characteristics of performance on
   a) logical judgment;
   b) achievement; and
   c) conservation of linguistic structure.
2. the interrelationships of each pair of these variables:
   a) logical judgment and achievement;
   b) logical judgment and language concepts; and
   c) language concepts and achievement.
3. factor analysis and multiple regression in which the interrelationships of the three main variables, along with certain demographic variables, were displayed.

Logical Judgments

The mean ratings across all stories were 1.52 (Rater 1) and 1.54 (Rater 2) of a possible 3.00 for Co-ordination and 1.70 and 1.74 for Data Source.(Table 1). The mean ratings for the two raters were similar within each scale for each story (Table 2). The mean ratings for Data Source were higher than for Co-ordination on all stories except Runner. The standard deviations (Table 2) ranged from 0.6 to 0.9 for most ratings on most stories, though they were slightly lower for the Data Source dimension of Sisters and slightly higher for Co-ordination dimension of Pilot.

TABLE 1

Mean Ratings for Logical Judgments

Mean Ratings

Story	Scale 1 Coordination		Scale 2 Data Source	
	Rater 1	Rater 2	Rater 1	Rater 2
1. Skating	1.49	1.51	1.77	1.81
2. Lynn	1.42	1.44	1.74	1.93
3. Sisters	1.44	1.42	1.65	1.65
4. Jane	1.26	1.23	1.72	1.63
5. Tall Buildings	1.72	1.72	1.84	1.86
6. Runner	1.77	1.77	1.54	1.61
7. Pilot	1.54	1.70	1.65	1.72

Standard Deviations

1. Skating	0.70	0.77	0.84	0.82
2. Lynn	0.82	0.83	0.69	0.74
3. Sisters	0.80	0.76	0.57	0.53
4. Jane	0.82	0.78	0.70	0.66
5. Tall Buildings	0.88	0.91	0.62	0.60
6. Runner	0.92	0.95	0.80	0.90
7. Pilot	1.01	1.01	0.84	0.91

Examination of the frequency distributions (Table 2) for ratings confirms and clarifies the picture presented by the means. For Co-ordination, there were very few subjects rated as Level 0 (support neither position with relevant evidence or arguments), a large proportion rated as Level 1 (supports one side), and a few at Levels 2 and 3. For Data Source there were again few Level 0 responses, but approximately equal numbers at Levels 1 and 2, and a few responses at Level 3.

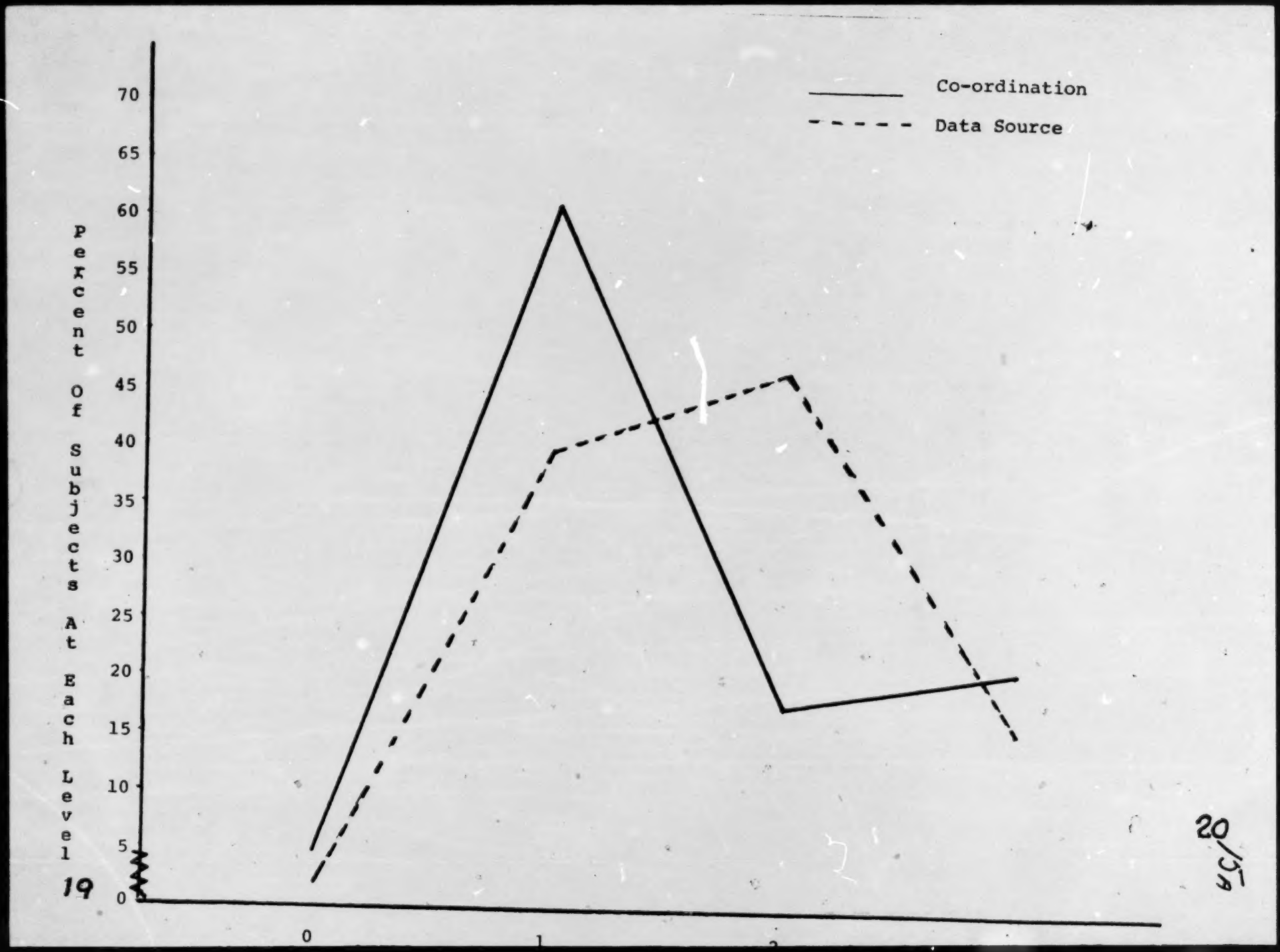
Raters indicated that scoring Co-ordination was quite easy but that the difference between ratings of 1 and 2 on Data Source required some thought. The distribution of ratings for Co-ordination was rather sharply peaked, with 40-60% of the subjects being rated as Level 1 (supports one side of a question). Specific characteristics of the passages appeared to influence somewhat the likelihood of Level 3 responses.

The distribution of ratings for Data Source formed a flatter curve. While 35-45% of the responses were categorized as Level 1, nearly as many were rated as Level 2, and 20-30% were rated Level 3 which required that the subject analyze the paragraph to note irrelevancies or missing data.

TABLE 2

Frequency of Various Ratings

		Coordination Level				Data Source Level			
		0	1	2	3	0	1	2	3
Skating	Rater 1	1	24	14	4	1	18	14	10
	Rater 2	1	25	11	6	1	16	16	10
Pilot	Rater 1	5	21	6	11	2	19	14	8
	Rater 2	4	18	8	13	3	16	14	10
Runner	Rater 1	0	24	5	14	1	25	10	7
	Rater 2	1	22	6	14	2	23	8	10
Tall Buildings	Rater 1	0	24	7	12	1	9	29	4
	Rater 2	0	25	5	13	1	8	30	4
Jane	Rater 1	6	24	9	4	1	15	22	5
	Rater 2	5	27	7	4	1	17	22	3
Sisters	Rater 1	1	29	6	7	0	17	24	2
	Rater 2	1	29	7	6	0	16	26	1
Lynn	Rater 1	2	28	6	7	0	17	20	6
	Rater 2	1	30	4	8	0	13	20	10
Co-ordination	average	2	25	7.2	8.8	1	16.4	19.2	6.4
Data Source	average	5%	61%	18%	21%	2%	40%	47%	16%


Co-ordination
Data Source
Percent Of Subjects At Each Level
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
1
2

19

20/54

Interrater reliability was examined at three levels:

a) between raters across all stories on each scale

b) between raters within each story on each scale

c) between each rater for each story on each scale

Interrater reliability between raters across all stories (Table 3) was quite acceptable. For Scale 1, Co-ordination, interrater reliability was .92. For Scale 2, Data Source, interrater reliability was .88. The moderate correlations on the off-diagonal (Table 3) indicate that although interrater agreement is greatest within a given scale, there is some generality. The responses of Rater 1 on Scale 1, for example, correlate .66 with those of Rater 2 on Scale 2.

Generally high interrater reliability was maintained within all stories on each scale except Scale 2 on the story, Sisters. Most other interrater correlations for each story were .90 or better (Table 4).

TABLE 3

Correlations Between Raters
Across All Stories On Each Scale

	Coord Rater 1 Scale 1	Data Source Rater 1 Scale 2	Coord Rater 2 Scale 1	Data Source Rater 2 Scale 2
Rater 1, Scale 1	1.00	.66	.92	.66
Rater 1, Scale 2		1.00	.61	.88
Rater 2, Scale 2			1.00	.66
Rater 2, Scale 2				1.00
Means	1.52	1.70	1.54	1.74
Standard Deviations	0.86	0.73	0.87	0.75

TABLE 4

Correlations Between Raters On Each Story on Each Scale

Story	Scale 1 Coordination	Scale 2 Data Source
	r =	r =
Skating	.94	.97
Lynn	.84	.85
Sisters	.94	.69
Jane	.91	.86
Tall Buildings	.97	.97
Runner	.92	.83
Pilot	.93	.93

Although there was good agreement between raters on the rating scales within each story, the correlations between stories (Table 5) were low to moderate. This indicates that a subject's rating on one story often bore little relationship to his score on other stories. For example, the correlation of Rater 1's rating for Co-ordination on the story Skating with ratings on the same scale by the same rater for other stories were:

Skating/Lynn, $r = .38$, $p < .01$; Skating/Sisters, $r = .12$, NS;
Skating/Jane, $r = .27$, $p < .05$; Skating/Tall Buildings, $r = .34$;
p .05; Skating/Runner, $r = .25$, NS;
Skating/Pilot, $r = .26$, $p < .05$.

Factor Structure for Peel Logical Judgment Rating

This same point is made in examining the factor structure for these ratings (Table 6). With only seven stories, nine factors were brought into rotation. Groups of ratings for both scales by both raters for Pilot, Skating, and Jane appeared on independent factors with no substantial loadings from other items. All ratings for Runner defined a factor on which all ratings for Lynn also showed moderate loadings, but Lynn also appeared in a separate factor. For Sisters, nearly equal loadings appeared on two different factors--while both ratings for Co-ordination on this story defined one factor, both ratings for Data Source appeared on another factor. A similar pattern is seen for the two scales on Tall Buildings.

TABLE 5

Correlation Matrix for Interrater Reliability on Logical Judgment

	Skating				Lynn				Sisters				Jane	
	Rater 1		Rater 2		Rater 1		Rater 2		Rater 1		Rater 2		Rater 1	
	Coord	Data	Coord	Data	Coord	Data	Coord	Data	Coord	Data	Coord	Data	Coord	Data
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.000													
2	.681	1.000												
3	.938	.595	1.000											
4	.654	.967	.568	1.000										
5	.379	.144	.369	.118	1.000									
6	.409	.100	.476	.081	.693	1.000								
7	.390	.117	.424	.089	.843	.660	1.000							
8	.297	.050	.359	.017	.677	.850	.757	1.000						
9	.116	.264	.167	.237	.438	.167	.457	.257	1.000					
10	.019	.223	-.018	.162	.014	-.110	.082	-.003	.294	1.000				
11	.142	.341	.195	.316	.434	.162	.418	.180	.943	.233	1.000			
12	- 043	.188	-.078	.175	.070	-.119	-.020	-.186	.318	.689	.370	1.000		
13	.274	.296	.241	.284	.226	.286	.216	.149	.078	.043	.129	.101	1.000	
14	.331	.332	.316	.238	.372	.290	.259	.192	.098	.167	.135	.181	.749	1.000
15	.352	.338	.313	.327	.215	.288	.169	.153	.022	-.080	.072	.028	.900	.686
16	.300	.228	.245	.177	.384	.309	.267	.142	.049	.153	.128	.235	.758	.857
17	.340	.296	.286	.255	.296	.192	.272	.236	.146	.133	.142	.093	.497	.526
18	.290	.109	.282	.033	.326	.235	.380	.237	.248	.038	.200	.041	.416	.389
19	.293	.256	.244	.215	.287	.224	.264	.219	.142	.129	.138	.090	.546	.548
20	.278	.076	.262	-.006	.265	.198	.319	.193	.232	.063	.182	.068	.413	.414
21	.253	.113	.307	.067	.633	.538	.639	.537	.338	.113	.311	-.073	.175	.192
22	.160	.119	.165	.083	.630	.559	.609	.592	.446	.314	.406	.114	-.032	-.025
23	.210	.050	.233	.024	.559	.415	.592	.488	.297	.110	.270	-.118	.189	.079
24	.311	.096	.299	.027	.580	.519	.623	.566	.315	.141	.280	-.046	.076	.047
25	.261	.094	.315	.065	.211	.234	.253	.116	.084	.165	.073	.001	.119	.115
26	.335	.185	.356	.144	.319	.292	.364	.267	.129	.038	.084	-.119	.132	.194
27	.313	.167	.326	.131	.241	.192	.278	.067	.140	.183	.137	.109	.124	.180
28	.293	.162	.312	.120	.415	.375	.423	.362	.241	.037	.207	-.108	.162	.174

	Jane		Tall Buildings				Runner				Pilot			
	Rater 2		Rater 1		Rater 2		Rater 1		Rater 2		Rater 1		Rater 2	
	Coord	Data	Coord	Data	Coord	Data	Coord	Data	Coord	Data	Coord	Data	Coord	Data
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
15	1.000													
16	.730	1.000												
17	.407	.310	1.000											
18	.328	.319	.573	1.000										
19	.429	.341	.971	.597	1.000									
20	.324	.349	.954	.969	.538	1.000								
21	.209	.247	.182	.206	.148	.198	1.000							
22	-.052	.071	.116	.133	.112	.110	.789	1.000						
23	.139	.164	.177	.138	.117	.109	.919	.736	1.000					
24	.104	.148	.247	.267	.211	.247	.831	.829	.864	1.000				
25	.110	.164	.199	.105	.245	.126	.111	.238	.158	.264	1.000			
26	.126	.147	.347	.210	.368	.231	.138	.214	.194	.315	.842	1.000		
27	.121	.185	.250	.110	.294	.125	.076	.205	.099	.231	.932	.823	1.000	
28	.127	.141	.376	.215	.394	.232	.262	.375	.338	.414	.791	.928	.786	1.000

Achievement

The initial mean for the total group on Total Reading scores (Table 6) on the California Achievement Test was 6.4, and the final reading score for the same subjects, after varying lengths of instructional contact, was 7.5. The mean scores for initial and final reading total scores for students categorized as Primary (grade equivalents 0 - 4.0), Intermediate (4.1 - 8.0), and Secondary (8.1 - 13.0), are also shown on Table 6. The greatest rate of increase was seen for students initially at the lowest levels. This was not necessarily the most rapid increase, since some of these students had had many hours of instruction.

Linguistic Conservation

The means for conservation of linguistic structure for the adult sample as a whole were 6.6 of a possible 8 responses, and 5.6 justifications. This is comparable to the pattern previously found for fifth graders. When the total adult group was divided into three levels on the basis of their initial California Achievement Test total reading grade equivalents (Primary, 0.0 to 4.0; Intermediate, 4.1 to 8.0; Secondary, 8.1 or higher), the means for the language task response were found to co-vary with reading level (Table 6 and Figure 2). As an example, the students with initial reading scores at primary levels had a mean of 3.6 for Linguistic Justification, while those students reading at a secondary level had a mean of 6.3.

TABLE 6

Comparison of Mean Scores in Reading and Language Concepts for Adults Categorized in Terms of Their Initial Reading Levels

	Primary	Intermediate	Secondary	Total
Grade equivalents	(0-4.0)	(4.1-8.0)	(8.1-14.0)	(0-14.0)
n=	(5)	(26)	(10)	(41)
Initial Reading Level	0.60	6.01	10.10	6.35
Final Reading Level	4.36	6.81	10.92	7.52
Linguistic Response	5.00	6.69	7.00	6.56
Linguistic Justification	3.60	5.73	6.30	5.61

As an additional referent, the mean found for this measure in another study, with college-level adults, was 7.9 of a possible 8.0. While ABE students at the lowest reading levels were not far above chance on this measure of concepts of language structure, the highest level students in the adult programs were not appreciabl different from college-level adults in their responses to this measure.

Factor Analysis of the Major Variables

As may be seen in Table 7, there were a number of significant intercorrelations among the major variables examined in this study. Response and Justification on the measure of language concepts had a correlation of .84, and both showed moderate correlations with each of the four achievement measures. There was a low positive correlation between Linguistic Justification and Logical Co-ordination, the aspect of Hutson's scoring of the Peel logical judgment tasks which most closely reflects a Piagetian view of logical development.

The highest grade level attained by the adults prior to entry into the Adult Learning Center program showed moderate positive correlations with each of the academic achievement variables (our school systems need an occasional morale boost), but nonsignificant relationships with the measures of linguistic conservation and logical judgment. Ratings on the scales designed to assess two aspects of logical judgment (co-ordination used) were correlated .90 with one another, but showed significant correlations with no variables other than Linguistic Justification.

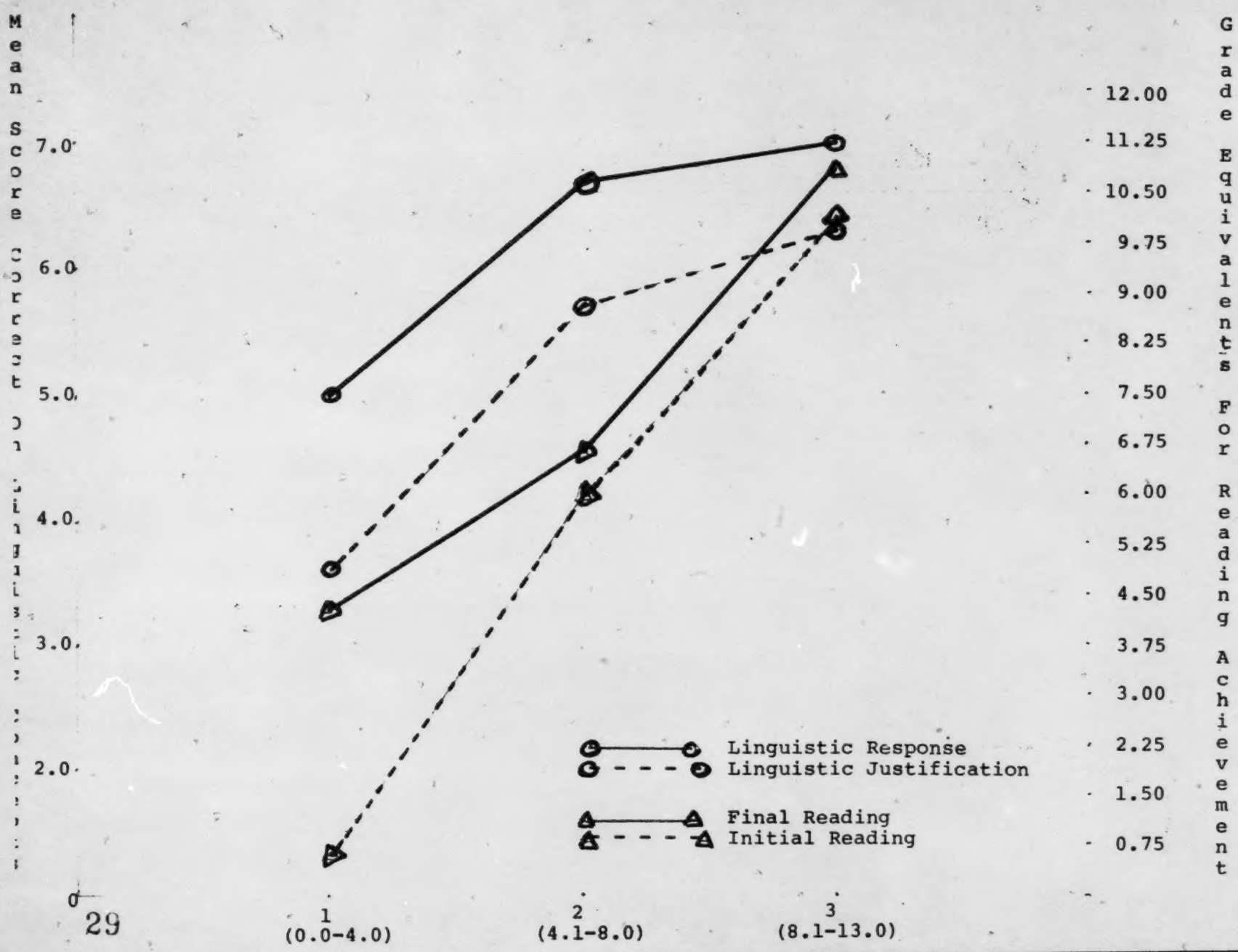

Mean Score Correct On Linguistic Variables
7.0
6.0
5.0
4.0
3.0
2.0
0
1
(0.0-4.0)
2
(4.1-8.0)
3
(8.1-13.0)
Linguistic Response
Linguistic Justification
Final Reading
Initial Reading
12.00
11.25
10.50
9.75
9.00
8.25
7.50
6.75
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
Grade Equivalents For Reading Achievement

TABLE 7

Correlations Among Language Concepts, Achievement, and Logical Judgments

		1	2	3	4	5	6	7	8	9
1.	Linguistic Response	1.00	.84**	.16	.49**	.33*	.50**	.47**	.26	.29
2.	Linguistic Justification		1.00	.27	.48**	.41**	.44**	.51**	.29	.36*
3.	Highest Prior Grade Level			1.00	.57**	.50**	.37*	.37*	- .18	- .16
4.	Initial Reading Achievement				1.00	.77**	.79**	.76**	.15	.16
5.	Initial Math Achievement					1.00	.72**	.63**	.04	.03
6.	Final Vocabulary Achievement						1.00	.77**	.18	.17
7.	Final Comprehension Achievement							1.00	.07	.11
8.	Logical Coordination								1.00	.90**
9.	Logical Source of Data									1.00

$n = 41$ * $p < .05$ ** $p < .01$

TABLE 8

Factor Structure for Language Concepts, Achievement, and Logical Judgments in Adults

		I	II
1.	Linguistic Response	.58	.48
2.	Linguistic Justification	.61	.50
3.	Highest Prior Grade Level	.65	-.30
4.	Initial Reading Achievement	.91	.11
5.	Initial Math Achievement	.84	-.03
6.	Final Vocabulary Achievement	.85	.17
7.	Final Comprehension Achievement	.85	.11
8.	Logical Coordination	-.01	.92
9.	Logical Source of Data	.01	.93
	Eigenvalues	4.36	2.09
	Proportion of total variance	46%	26%

The factor structure of the nine variables represented in this correlation matrix was examined using squared multiple correlations as the communality estimate. Factors with eigenvalues greater than 1.0 were rotated to a normal varimax criterion, yielding the two-factor solution displayed in Table 8, which accounted for 72% of the total variance. Factor I was primarily defined by high loadings for the achievement variables, but also showed moderate positive loadings for Linguistic Conservation Response and Justification, and for highest prior grade. There were essentially zero loadings on this factor for the two aspects of logical judgment.

The relationship of the language concepts and reading achievement is especially worth noting because performances on the Linguistic Conservation and on Reading Achievement measures were not linked by similarities in stimulus materials (in the Linguistic Conservation task the sentence pairs were read to the students, while in the Reading Achievement test the students read to themselves) or in the type of response required (in the Linguistic Conservation task subjects produced a verbal justification, while in the Reading Achievement test they selected from among several written responses). It also seems unlikely that any previous academic training would have provided direct training with the questions asked in the Linguistic Conservation task, though reading in general might give an individual more familiarity with constructions such as the passive, which is used relatively seldom in informal oral language.

Factor II was primarily defined by high loadings for the two aspects of the Logical Judgment task, but also showed moderate positive loadings for Linguistic Response and Justification. Loadings for achievement on this factor were quite low. Interesting highest grade attained prior to entry in the program showed a low negative loading on this factor; greater previous exposure to academic training was not especially helpful in relation to performance on the Peel tasks used in this study, which may have emphasized application of judgments in analyzing social situations.

Factor Analysis of the Major Variables and Demographic Variables

As expanded version of the correlation matrix (Table 9) was also entered into factor analysis in order to examine the relationship of several demographic variables (sex, age, and ethnic group) with the major variables in the first analysis. The negative correlations of age with achievement found here probably are not generalizable, but reflect a peculiarity of the sample tested. The oldest subjects in this group tended to have had less prior exposure to education and to be functioning at lower academic levels, and as a group appeared less intellectually able than the younger students, some of whom only needed to pick up a few credits for high school graduation. There were, of course, exceptions.

TABLE 9

Correlation of Matrix for Major Variables and Demographic Variables

	1	2	3	4	5	6	7	8	9	10	11	12
	Sex	Ling. Resp.	Ling. Justif.	Age	Highest Prior Grade	Ethnic	Init. Rdg.	Init. Math	Final Vocab.	Final Comp.	Logic Coor.	Logical Data Source
1. Sex	1.00											
2. Ling. Resp.	- .10	1.00										
3. Ling. Justif.	- .27	.84	1.00									
4. Age	.03	- .39	- .43	1.00								
5. Highest Prior Grade	.13	.16	.27	- .73	1.00							
6. Ethnic	.19	.04	.01	- .03	.14	1.00						
7. Init. Rdg.	- .14	.49	.48	- .49	.57	- .18	1.00					
8. Init. Math	- .01	.33	.41	- .50	.50	- .05	.77	1.00				
9. Final Vocab.	- .05	.50	.44	- .31	.37	- .07	.79	.72	1.00			
10. Final Comp.	- .19	.47	.51	- .35	.37	- .11	.76	.63	.77	1.00		
11. Logic Coor.	- .06	.26	.29	.16	- .18	.02	.15	.04	.18	.07	1.00	
12. Logical Data Source	- .02	.29	.36	.14	- .16	.01	.16	.03	.17	.11	.90	1.00
Squared Multiple Correlations	.38	.85	.85	.69	.77	.24	.86	.75	.77	.71	.83	.84

The correlations of sex and of ethnic status with other variables were not significantly different from zero. Correlation of linguistic conservation with ethnic group was .04, which suggests that the measure was not strongly biased in favor of one language group. Certain qualifications should be noted, however. First, dialects are not as strongly marked in this medium-sized north-eastern industrial city as in some southern rural areas or massive inner-city areas. Second, although there was a wide range of ability in both groups, there seemed to be a proportionately greater share of lower ability subjects among the white students tested in this center than among the black students; it may be that both groups were equally far from a typical middle-class standard English speaking adult population.

This correlation matrix was factor analyzed, using squared multiple correlations on the diagonal, and factors with eigen-values greater than 1.0 rotated to normal varimax criterion. This procedure yielded a four-factor structure accounting for 79% of the total variance (see Table 10). Factor I accounted for 32% of the total variance or 40% of the common variance, but each of the other factors contributed appreciably.

TABLE 10

Factor Structure for Major Variables
and Demographic Variables

Variables	Factors I	II	III	IV
1. Sex	.07	.08	.70	- .46
2. Linguistic Response	.32	.24	.03	.78
3. Linguistic Justification	.33	.23	- .04	.85
4. Age	- .47	.40	- .30	- .51
5. Highest Prior Grade Level	.59	- .37	.45	.22
6. Ethnic	- .21	.03	.73	.19
7. Initial Reading Achievement	.90	.06	- .08	.24
8. Initial Math Achievement	.87	- .04	.06	.12
9. Final Vocabulary Achievement	.86	.17	- .06	.15
10. Final Comprehension Achievement	.80	.05	- .19	.27
11. Logical Coordination	.06	.93	.03	.13
12. Logical Source of Data	.07	.92	.05	.17
Eigenvalues	4.72	2.26	1.33	1.12
Proportion of total variance	32%	18%	11%	18%

Factor I was defined primarily in terms of the achievement measures, all of which had positive loadings of .80 to .90 on this factor. Highest grade attained prior to entry into the program also had moderate positive loadings on this factor. Age had a moderate negative loading on this factor, but this should be interpreted not as a general phenomenon but as the sample-specific of the distribution of ability levels within this sample--several of the oldest students may or may not have been as able initially as most students in this group but grew up at a time when school attendance was not universal and they had had only a few years of schooling. There were also small but significant loadings for the measures of Linguistic Conservation on this achievement factor.

Factor II was defined by high positive loadings for the two scales or aspects of logical judgment. Age showed a moderate positive loading (.40), indicating that years of experience in living may give at least some advantage in social judgment, which this measure seemed to tap. The negative loading (-.37) for highest grade level on this factor should be interpreted bearing in mind that the oldest subjects in this sample tended to be those with fewest years of schooling. If this relationship does not exist in another sample, the negative loading for age might not be replicated.

Factor III had essentially no loadings for the test variables, but indicated the interrelationships among the demographic variables. Positive loadings of about .70 are seen for both sex and ethnic

status, which may indicate that at least cumulatively, over the total battery, females tended to do better than males, and black students tended to do better than the white students in this sample. Another possibility is that this correlation is attributable to the fact that there were simply more males who were white in this group. Age showed a low negative loading--the oldest students tended to be male and to be white, though the students at other ages were more mixed.

Factor IV had highest positive loadings for the measure of Linguistic Conservation (Justification, .85, Response, .78). It also had moderate negative loadings for sex and for age. There were no significant correlations between sex and the linguistic concept variables, but the older students in this sample did less well on linguistic concepts.

In comparing the structures yielded by the two sets of factor analysis, it appears that the introduction of the additional variance in the form of demographic variables served primarily to (1) add another factor (Factor III) which described the interrelationships among the demographic variables, and (2) to expand from a two-factor structure to a three-factor structure (excluding the demographic factor). The principal difference is that the three-factor structure in the second analysis showed the linguistic concepts as a separate factor, with secondary loadings on achievement, rather than forcing the linguistic concepts onto the other two factors (achievement and social judgment). Reexamination of the correlation matrix tends to support a three-factor (plus

demographics) solution--the correlations of Linguistic Response and Justification with the Hutson-Peel scales of logical judgment were generally nonsignificant, except for a correlation of .36 between Linguistic Justification and Hutson-Peel Data Source, which was significant at $p < .05$.

The relationships observed between age and other variables in this study were quite likely due to a distribution specific to this sample and not generalizable. Sex and ethnic status were apparently not heavily implicated in the achievement and language concept measures, but played a greater role in the logical judgments task. It may be that if the content used in Peel-type tasks were less heavily loaded with social content and were instead more involved with content such as physics or mechanics or even with other social issues, a different pattern would be seen.

Multiple Regression

The correlations of each variable with all others were used to determine an optimal regression equation (Table 11) for predicting performance on any of the major variables from all of the other major variables.

TABLE 11

Regression of Each Variable on All Others

	1 Sex	2 Ling. Resp.	3 Ling. Justif.	4 Age	5 Highest Prior Grade	6 Ethnic	7 Init. Rdg.	8 Init. Math	9 Final Vocab.	10 Final Comp.	11 Logic Coor.	12 Logical Data Source
1. Sex	.00	.22	- .24	.15	.25	- .03	- .17	.21	- .00	- .02	- .09	.14
2. Ling. Resp.	.86	.00	.82	- .55	- .65	.56	.42	- .62	.40	- .23	.11	- .22
3. Ling. Justif.	- .98	.83	.00	.20	.50	- .34	- .36	.55	- .29	.36	- .14	.35
4. Age	.30	- .27	.10	.00	- .56	.27	.11	- .31	.20	- .02	.05	- .02
5. Highest Prior Grade	.67	- .43	.33	- .75	.00	.68	.43	- .32	.11	- .14	- .01	- .11
6. Ethnic	- .03	.11	- .07	.11	.21	.00	- .17	.10	.00	.04	.03	.01
7. Init. Rdg.	- .71	.45	- .39	.25	.69	- .88	.00	.65	.18	.50	.03	.16
8. Init. Math	.51	- .38	.33	- .39	- .29	.31	.37	.00	.37	- .10	.07	- .16
9. Final Vocab.	- .01	.26	- .19	.27	.11	.00	.11	.41	.00	.48	.07	- .02
10. Final Comp.	- .05	- .12	.19	- .02	- .11	.10	.25	- .08	.39	.00	- .13	.04
11. Logic Coor.	- .32	.10	- .12	.08	- .01	.13	.03	.11	.09	- .22	.00	.83
12. Logical Data Source	.55	- .22	.33	- .03	- .17	.05	.14	- .25	- .02	.07	.90	.00

Not unexpectedly, the best predictions for final grade equivalent on comprehension were other measures of achievement. The weights associated with these measures were .50 for initial total reading score and .48 for final vocabulary. A weight of .36, however, was associated with Linguistic Justification, which apparently added significantly to the prediction.

Prediction of performance on the Logical Co-ordination Scale was almost entirely a function of performance on the Logical Data Source Scale, with a weight of .90. Prediction of performance on the Logical Data Source Scale was again heavily saturated with performance on the Co-ordination Scale, but a weight of .35 was also associated with Linguistic Justification, indicating some additional contribution.

TABLE 12

Regression Weights for Predicting

Linguistic Response and Justification

	To Predict Linguistic Response	To Predict Linguistic Justification
Linguistic Response		.82
Linguistic Justification	.83	
Initial Reading	.45	-.39
Initial Math	-.38	.33
Logical Source of Data		.33
Highest Prior Grade Level	-.43	.33
Age		

The results of regression analyses for the measures of linguistic concepts were less clear. The two criteria for Linguistic Concepts, Response, and Justification, were each the best predictor for the other. Logical Source of Data had a weighting of .33 in predicting Linguistic Justification. For most other variables (notably initial reading, initial math, and highest grade level), the weights associated with the two criteria for Linguistic Concepts were approximately equal in value and opposite in sign.

The most likely interpretation is that, given the information contributed by the first predictor (such as Linguistic Response) in predicting Linguistic Justification, some other variables contributed a small amount of additional information, and some acted as suppressor variables. Since, as seen in Table 9, the correlation of initial reading and Linguistic Justification was a positive .48, it is probable that initial reading was operating as a suppressor variable in the regression equation for predicting Linguistic Justification. Related to this is the fact that Response and Justification were themselves highly correlated. Some of these relationships could be probed further by means of stepwise multiple regression.

SUMMARY

The major findings of this study were:

(1) concepts of language structure vary in adults

(2) degree of success on the language concepts measure covaries with reading level for adults in a reading skill development program

(3) good interrater reliability was attained for the tasks logical judgment

(4) logical judgment as assessed by the stimulus materials and the rating scheme employed, was not found to be related to achievement

(5) the results were found to be generally similar across sex and ethnic groups

(6) differences by age were attributed to a peculiarity of the specific sample tested

(7) when demographic variables were included in the factor analysis, the factors observed included one factor which described interrelationships of sex, age, and ethnic status in this sample, and one factor each for achievement, language concepts, and logical judgments, with language concepts also loading on the achievement factor.

IMPLICATIONS

The primary purpose of this project was to select or devise a means of tapping cognitive levels in adults. The secondary purpose was to determine whether such a measure was related to reading comprehension. If they were found to be related, it was

anticipated that cognitive level might later be used to place adults for instructional purposes, using different tactics for adults at various levels.

An instrument was selected, tried out, revised, and used again. A rating system for the logical judgments was developed, tried out, and revised. Two raters were trained to use the system, and applied it to each of the subject's responses to each of the seven stories. Interrater reliability was high, breeding confidence in the reliability of this measure. The validity of the measure could not be fully assessed within the limits of the present study, but it seems best to describe the Peel tasks as assessing logical judgments in social content. It may be that tasks similar in format but more similar in content to the achievement tests would show stronger relationships. The logical tasks are of interest in themselves, and deserve further study.

The other limitation which should be noted is that the California Achievement Test does not necessarily ask very searching questions. Higher level cognitive functioning may be irrelevant to performance on low-level comprehension questions. In addition, the comprehension subtest includes some items (such as map-reading) marginally relevant to the type of comprehension of interest here. It may be desirable at some later point to reanalyze the data, relating it to a "cleaned up" comprehension task with irrelevant items excluded, or to use in another study a measure requiring

higher levels of comprehension. As of now, however, the conclusion must be that adults' performance on the Peel tasks for logical judgment is unrelated to performance on the California Achievement Test.

With this strong reservation in mind, it may nonetheless be true that awareness of the logical processes assessed by the tasks used in this study could be a "tool" concept for the teacher. The concept of qualitative differences in logical judgment may help a teacher to understand why a student is having difficulty in co-ordinating information from a lesson. If a student typically performs on test and nontest materials at a relatively low cognitive level, the teacher would probably contribute most to his growth by using questions which draw out from the student mostly facts and low level inferences, and occasionally lead him to a slightly higher co-ordination of information.

On the other hand, if a student shows capability for higher cognitive operations, the teacher might occasionally use open-ended interpretive or evaluative questions that stimulate the student and legitimize his use of these skills in reading. These curricular implications may be examined in another year. The relationship of reading comprehension and logical ability is likely to be of greatest importance at the lowest ability levels and the highest levels of difficulty of content or questions. It may be necessary to refine the measure used for comprehension as well as the measure of logical judgment, and to attempt to specify more closely the conditions of "readability" and question type under which differences in cognitive levels affect performance.

While no single study can answer all questions, this study and several other recent studies using the Peel tasks with high school and junior high school students may suggest directions to be pursued in our search for understanding of psychological factors related to the development of comprehension in the adult learner.

FOOTNOTES

1. Raters were trained and appeared to be operating at an acceptable level of interrater reliability. There were, however, numerous other trips and other activities scheduled for the two raters between sessions of rating responses to the Peel tasks. Since the central question was whether subjects, logical judgments were related to their reading achievement, it was important to ensure stable ratings. For this reason, when the ratings were completed, the two raters were asked to reexamine their ratings and, to compare their ratings with the guidelines. They were not instructed to change their ratings. This procedure, while it tended to balance the effect of possible shifts in ratings due to the many other commitments of the raters, may also have produced somewhat optimistic estimates of reliability. If this is considered an upper limit, a lower limit reliability coefficient seems unlikely to be less than .75, and probably higher for Coordination than for Data Source. Since the correlation between the two scales is high, it may at times be useful to use only the Coordination scale, which appears easier for raters to use.

TASKS AND SCORING FOR MEASURE OF LOGICAL JUDGMENTS IN ADULTS

These tasks were developed as an attempt to measure cognitive levels in adult basic education students. The following paragraphs were based upon the work of Peel in England, selected and modified to fit American usage. Subjects were individually tested. Each passage was read to the subject. The subjects' oral responses to questions were noted by the examiners and later scored by two raters.

Name_____ Age_____

Years of formal schooling _____ Sex_____

RUNNER

It takes a lot of strength and determination to be a champion runner. Many people train and try hard but few succeed. Carol was a tall, strong girl who had always wanted to represent her school at the County Sports Meet. She trained hard and won her race in the preliminary rounds. But on the morning of the race, she slipped and sprained her ankle so that she could not take part in the finals.

(1) Would Carol have won the final?

_____

(2) How do you know?

_____

_____

_____

* * * *

SKATING

I've seen Mary standing at the edge of the skating rink with skates on her feet. I often see her walking and running to school and standing around. I've seen her watching the skating at the rink and she is always talking about skating.

(1) Can Mary skate?

_____

(2) Why do you think so?

_____

_____

_____

* *

TALL BUILDINGS

Each year the number of accidents rises and hundreds of people are killed or seriously injured on the roads. Many of the new buildings in this city are very high, and last week a man fell from the tenth floor of a tall building and died on the pavement below.

(1) Is it dangerous to live in tall buildings?

_____

(2) Why do you say that?

_____

_____

_____

* *

SISTERS

When Jill started to work, she saved some of her money so that she could take her young sister, Ann, for a holiday in the mountains. When they were on their holiday, the girls went for a walk in the hills, and Ann carried the pack with their lunch and their coats in it. The path was slippery and Ann fell down, dropping the pack down a steep cliff. They looked down at it and Jill said, "I've a good mind to throw you down to get it."

(1) Was Jill kind to her sister?

_____

(2) How do you know?

_____

_____

_____

* * * * * * * * * * * * * * * * *

LYNN

Lynn is a large town with a busy railway crossing that attracts boys who are interested in train-spotting. Burton is a small place not far away, and many people who live there do their shopping in Lynn because there are more shops. The railroad recently decided to close Burton station and run no more trains from there to Lynn.

(1) Should Burton station be closed?

_____

(2) Why do you say that?

_____

_____

PILOT

Only brave pilots are allowed to fly over high mountains. This summer a fighter pilot flying over the Alps ran into an aerial cable car, and cut a main cable, causing some cars to fall to the valley below. Several people were killed and many others had to spend the night suspended above the valley.

(1) Was the pilot a careful airman?

_____

(2) Why do you think so?

_____

_____

_____

* * * * * * * * * * * * * * * * *

JANE

Jane is a very clever fifteen-year-old girl who is preparing for her final exams. One evening, as Jane was doing her homework, her mother asked her to look after her younger brother, David, while she went out. David wandered from the living room into the kitchen, got hold of a jar of jam, ate a lot of it, covered his clothes with it, an spilled it on some clean washing in a basket so that it was ruined.

(1) Was Jane a careless person?

_____

(2) Why do you think so?

_____

_____

_____

* * * * * * * * * * * * * * * * *

Guidelines for Scoring

Scoring is not based on the answer to the first question but on certain aspects of the reasoning displayed in the total response. A useful procedure is to rate all responses in terms of Coordination and then to score all responses in terms of Data Source. Responses are rated 0-3 on each of the two dimensions:

I. Coordination of Information

0 - Supports neither position with relevant evidence or arguments.

1 - Supports one position with relevant arguments.

2 - Supports both sides with some relevant evidence, but does not coordinate them, or states that the answer cannot be determined.

3 - Resolves contradiction with relevant evidence, or specifies why the answer cannot be determined.

II. Data Source Used

0 - Uses only irrelevant fact or none; or essentially restates the question.

1 - Uses facts from the story or inferences which are little more than paraphrases or simple associations or clichés.

2 - Goes beyond the facts in the story with inferences which are related to facts but extend beyond the

2 - facts given.

3 - Analyzes the paragraph to note irrelevancies or missing data.

With seven passages rated 0 - 3, a subject's total scores on each of these two dimensions can range from 0 - 21.

END

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